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ABSTRACT

The interdisciplinary approach to education applies methods and language from more than one discipline to examine a central theme, issue, problem, topic, or experience, and is utilized in order to enhance the ability of students to acquire the knowledge, skills, and attitudes of various disciplines. This guide to developing interddisciplinary units is organized into a series of seven steps: (1) problem selection and concept outline; (2) content outline; (3) thinking processes; (4) planning prototype; (5) instructional objectives; (6) learning activities; and (7) evaluation procedures. Appendices consist of timelines; concept and content outline forms, planning prototype sheets, a worksheet for instructional objectives and activities, and an assessment planning chart; unit samples submitted and selected as examples for interdisciplinary unit development; and a guide to program support. (LL)

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Content Connections:

CREATING INTERDISCIPLINARY UNITS

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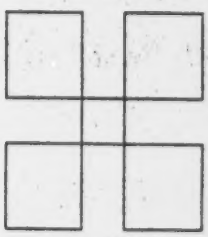

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Introduction

THE ALASKA DEPARTMENT OF EDUCATION, Office of Basic Education, has produced this guide to help educators develop interdisciplinary units. As used in this guide, "interdisciplinary" refers to an approach to education which intentionally applies methods and language from more than one discipline to examine a central theme, issue, problem, topic, or experience. The value of this approach is that it enhances the ability of the student to acquire the knowledge, skills, and attitudes of the various disciplines.

Interest in interdisciplinary education has grown out of the growing realization that

- present educational settings fractionalize students' time,
- the amount of knowledge available is doubling every five years,
- research suggests that students have a range of different forms of intelligence,
- curriculum offerings can lack any "real life" applications.

The fractionalization of the curriculum had its beginnings during our country's agricultural period. At that time it seemed to make sense to teach each subject as an entity unto itself. There was a definable body of knowledge that society deemed necessary for every American to learn. In order to teach this body of knowledge the school day was set up in specific time periods during which each subject discipline was taught. This practice

continues today. Even elementary schools have developed schedules where students leave their "home room" to work with a teacher who teaches them math or science. The student, for the most part, is left with the task to make connections among the curriculum areas. Some students can find it difficult to relate this school practice to the real world, where they must deal with life's curriculum as an integrated whole.

The task of teaching all of the available information is overwhelming. The United States has become an information society. Writing in Megatrends (1982), Naisbit indicated that "Scientific and technical information now increases 13 percent per year, which means it doubles every 5.5 years." Additionally, Naisbit reported that "by 1985 the volume of information will be somewhere between four and seven times what it was only a few years earlier." Schools must develop a means to teach students how to think and deal with the information.

Gardner (1982) defines intelligence as the capacity to do something useful in society. In his book *Frames of Mind: A Theory of Multiple Intelligences* Gardner describes seven distinct forms of intelligence. These intelligences are verbal-linguistic, mathematical-logical, spatial, bodily kinesthetic, musical, interpersonal, and intrapersonal. Gardner states that the mathematical-logical and verbal-linguistic forms of intelligence are the most favored in our society. It follows therefore that the American Schools are set up to favor these intelligences. Samples, in his book *Openmind Wholemind*, states that "Schools that overemphasize the mathematical-logical and linguistic intelligences (the basics!) deny children the experience of developing as whole human beings with diverse talents." By making interconnections among the different disciplines through the interdisciplinary approach, students are able to explore the multiple forms of intelligence they possess. Students' learning will be enriched and society will be the beneficiary in the process.

Sometimes students experience the basics of reading, arithmetic and writing apart from the realities of how the information will be used. Through the interdisciplinary process students can begin to see the connections. Working in teams on projects, bringing to bear the multiple forms of intelligence the group possesses, they can begin to solve real problems (for them), find motivation in the excitement of involvement, and understand the relevance of their school tasks to meaningful applications.

We hope that this guide will prove a useful tool as you work to provide quality interdisciplinary education for your students. We would appreciate your comments or suggestions. A form is provided at the end of this document for your response.

Step One: Concept Outline

Selecting a Problem

The first step in the Interdisciplinary Unit Design is to select a problem or concept which can be considered for an interdisciplinary unit, and develop a brief Concept Outline. In order to accomplish the development it is necessary to ensure that the unit or course being developed fits into an interdisciplinary scope and sequence. In doing this work each of the curricula of the different disciplines must become part of the resources used in the unit's development. In essence, the scope and sequence of each discipline becomes the antecedent for the interdisciplinary scope and sequence. In Jacobs' words (1989) it is a "must" that the interdisciplinary approach avoid the Potpourri Problem. That is "...many units become a sampling of knowledge from each discipline." She continues to observe that "unlike the disciplines that have an inherent scope and sequence used by curriculum planners, there is no general structure in interdisciplinary work."

Remember, the interdisciplinary unit can be very minimal or very extensive in scope depending upon your desired outcome. It should include at least two subject areas to be considered interdisciplinary. The unit should be designed to be instructive and fun. The following list was generated using the above criteria and brainstorming techniques:

- Animal control
- Design an energy efficient home
- Research tourism in the area
- Research the subsistence issue
- Investigate parks development
- Investigate land use in the area
- Impact of media on teens
- Local government
- Excellence in education
- Teen crime

- Nutrition concerns
- Freedom of the press
- Food consumption vs population
- Pacific Rim relations
- Poverty and its ramifications
- Man vs. nature conflicts
- Depression—causes and effects
- Earthquake awareness
- Moose range research
- Chart town growth
- Fishing industry issues.
- Aviation
- Who are teenagers of the 90's?
- Environmental concerns
- Drugs and alcohol
- Arms agreement
- HIV/AIDS issues
- Power sources
- School funding/forward funding
- Fish and Wildlife issues
- Surviving in a low economy
- Foreign language issue
- School discipline
- Teen suicide
- Robotics
- Persian Gulf Crisis

After generating a list of problems or concepts, select which problem or concept you will pursue by using the following questions:

- What discipline areas will be included in the unit?
- Are the scope and sequences of the subject area curricula available?
- How many students will it involve - the entire class or a subgroup?
- How much time is required (or desired) to accomplish the interdisciplinary unit? Given timeline constraints, is the amount of time reasonable?
- How much library research will be necessary to design the unit?
- How might the interdisciplinary unit affect, if at all, other classroom teachers?

- What kinds of activities will you want to use? For example, will you want students to build a model, create a graph, draw charts, write papers, etc.

Select a problem/concept for further development

When selecting a problem/concept for further development and consideration for student involvement, it is advantageous to pay attention to student and teacher interest. This is your opportunity to be creative. Design enjoyment, by you and your students, into the unit. If the interdisciplinary unit is about a subject the student enjoys and with which they want to be involved, they are more apt to be attentive. Also, it is important that the unit be of interest to you, the teacher.

Concept Outline

In order to make the development of an interdisciplinary unit more real the reader will be guided through an actual example. For the purposes of this example, **aviation** will be used for the interdisciplinary unit design. The title of the unit is ***Touch and Goes.*** A complete Concept Outline for Touch and Goes is found on the next page. A copy of the Concept Outline form can be found in Appendix A.

Concept Outline

Title Touch and Goes

Question: What is aviation all about?

Areas of Study

- Princples of flight
- Parts of a plane
- Meteorology
- Careers
- Types of aircraft
- History of aviation
- Aerospace
- Model airplane and rocket building

Methods

- Airport visitation
- Lectures covering the material
- Presenters
- Computer flight simulator
- Model building and flying
- Readings and discussion

End Products

- Final oral presentation (using a model, written report or demonstration).
- Models
- Instrument panel construction
- Daily log
- Briefing book
- Slides of projects

Step Two:
Content Outline

The next step in the Interdisciplinary Unit Design will be to add more substance to your chosen problem. In order to add more substance, specific steps in unit development are listed below. You are familiar with unit development; however, in order to produce some commonality in process and product, follow these suggested steps. According to Treffinger, Hohn and Feldhusen (1979) an instructional unit should have these five important characteristics.

- It specifies clearly the major learning outcomes for the students (content objectives).
- It identifies several different levels of thinking for the students, so learning will not be restricted to memorization (process levels).
- It describes procedures for adapting learning experiences for different students (learner characteristics).
- For each objective it identifies one or more possible learning and teaching activities for the students (learning activities).
- For each objective it specifies the procedures that will be used to evaluate student performance (evaluation procedures).

In the first step of the interdisciplinary unit design, a Concept Outline was written. In Step Two you will write a ***Content Outline***. There are five important reasons for developing a content outline. To do so will:

- aid in the writing of subsequent steps (for example you will need to plan and write learning outcomes or objectives to ensure that the content is covered);
- serve to effectively coordinate the various parts of the unit;
- provide a more effective means to evaluate the content of the unit;
- insure that important topics have not inadvertently been overlooked; and,
- aid in the writing of assessment measures.

When developing the Content Outline, the reader must be cognizant of the need to focus on the discipline curricula and their attendant scope and sequences. Too, one must be concerned with the polarity problem (Jacobs, 1989). According to Jacobs "traditionally, interdisciplinarity and the discipline fields have been seen as an either/or polarity, which has promoted a range of conflicts." The most obvious of these conflicts is a lack of clarity that the discipline fields may have, but also the potential for tensions among teachers. To obviate the problem of polarity, Jacob suggests a need for "...both interdisciplinary and discipline-field perspectives in design."

In developing the content outline, it is important to keep the audience in focus as well. Treffinger, Hohn and Feldhusen (1979), in their book *Reach Each You Teach* indicate that in designing a content outline one must consider aspects of the students. That is, what are their specific characteristics, needs and interests? The students themselves are often overlooked by teachers as one of the basic and useful resources in planning instruction. Treffinger, et. al. (1979) list the following:

Student Characteristics

When thinking about student characteristics give some thought to questions like:

- What do the students know about this topic?
- What, if anything, have students previously learned that relates to this concept?
- What influence, if any, will the students' level of intellectual development have on the content outline?
- What kinds of learning styles and preferences among individual students will have to be taken into account?
- What prior experiences might some students have that relate to this unit?

Student Needs

When planning a new unit of instruction, think about the specific personal and learning needs of your students. For example you may wish to ask:

- Will they need concrete materials they can see and touch and smell?
- Will they need some special experiences to arouse curiosity and heighten their motivation?
- Is the topic of the unit one that should be exciting and interesting for most all of your students?
- Is it really an important unit?
- Have they done it before?

Student Interests

You may wish to involve the students in the actual planning of the unit. You may discover that they already know much about the topic. Too, although their initial knowledge may be limited, their ideas and questions may guide you in planning the unit so that their enthusiasm and motivation can be maintained at a high level.

Preparing the Content Outline

In planning your content outline use these specific guidelines to help.

- *Collect ideas from as many sources as you possibly can.*

  Initially, create an exhaustive list by using as many resources, including your and your students' ideas. Create an "idea trap" file. Using a 3 X 5 card, record the idea and place it in your file. When you write the idea on a 3 X 5 card be sure to include the specific source (bibliography) in the event you need to return to the source. Develop a filing system which meets your organization preference. You may wish to begin with some general categories.

  During this process remember that in the brainstorming mode all ideas are important. You may wish to discard cards at a later date, but for now they will serve as a source for further brainstorming.

- *Use your friends and fellow teachers as additional sources for your content gathering.*

  As with the other ideas you have gathered, record these new ideas on 3 X 5 card and place them in your file. As with the other cards, indicate the source of the idea. This may be important for two reasons. First, you may wish to go back to the source of the idea for clarification; and second, you may also wish to recognize the contributor.

- *Organize your ideas into general topic areas.*

  This process will be facilitated by how well you organized your filing system. Initially using the general categories of your filing system, group the ideas. For those cards which now have no apparent place, either organize them under other categories or "fit" them into the established categories. These categories then become the content outline

■ *The final step will be to organize the categories into a logical sequence that makes sense to you.*

This organization is not critical because you want the flexibility to be able to go back and rearrange the order, if necessary. The goal in this step is to get the outline into a sequence that will be useful to you. This will facilitate the planning to follow.

Content Outline

Title Touch and Goes

I. Principles of Flight
- A. Lift
- B. Drag
- C. Weight
- D. Thrust

II. Parts of a Plane
- A. Fuselage
- B. Wing
  1. aileron
  2. flaps
  3. lights
  4. fuel tanks
- C. Landing Gear
- D. Vertical stabilizer
  1. rudder
  2. light
- E. Horizontal stabilizer
- F. Instrument Panel

III. Meterology
- A. Fronts
  1. cold front
  2. warm front
  3. occluded front
  4. stationary front
- B. Cloud formation
  1. cumulus
  2. stratus
  3. lenticular
- C. Pressure Systems
- D. Hazards to aviation
  1. Icing
  2. turbulence
  3. thunderstorms
  4. instrument conditions
- E. Weather briefings
  1. pilot reports
  2. terminal forecast
  3. winds aloft

Continued next page

Content Outline

Continued

IV. Charts
- A. Types
- B. Interpretation(symbols, etc.)

V. Careers
- A. Pilot (commercial, Private, instrument, etc.)
- B. Mechanic
- C. Flight attendant
- D. Astronaut
- E. Navigator
- F. Meterologist
- F. Air Flight Controller
- H. Fueling technician
- I. Fire person
- J. Aeronautical engineer

VI. Types of Aircraft
- A. Military
  1. transport
  2. fighter
  3. bomber
  4. helicopters
- B. Commercial
  1. passenger
  2. cargo
- C. Private
  1. prop
  2. jet
- D. Blimps

VII. History of Aviation
- A. Development of aviation
  1. aviators who contributed (Wright Brother, Earhart, Lindberg, etc.)
  2. aircraft technology
- B. Significant events

VIII. Aerospace
- A. Liftoff and orbital mechanics
  1. parts of shuttle, rocket engines and flight
  2. maneuvering in space
- B. Adapting to space
  1. weightlessness
  2. living in space and fitness
- C. Global perspectives
  1. satellites (communication, reconaissance/ survelance)
  2. Hubbel Telescope
  3. Space station
  4. Exploration
- D. Impact of aerospace technology

Step Three: Thinking Processes

The next step in the Interdisciplinary Unit Design will be to look at thinking processes. You may have noted that the outline describes only academic content, that is material that the students learn through listening or reading, thinking and remembering. This type of content is usually referred to as *cognitive*, meaning that it requires intellectual responses. You are encouraged to include the *affective* and *psychomotor* domains in your unit as well. *Affective* learning refers to learning attitudes, values, and feelings. *Psychomotor* learning includes physical responses and skills. This book will not go into detail relative to the affective and psychomotor domains, but, the reader may include them using the process outlined in this book.

When developing the content outline, one may notice that the topics are broad, sketchy and rather vague. In order to add more specificity to the Unit, we will use Quellmalz's cognitive taxonomy of objectives. Quellmalz (1985) categorizes objectives into five areas. These categories are; 1) recall, 2) analysis, 3) comparison, 4) inference and 5) evaluation. Meanings for these categories follow.

Recall

This level of the taxonomy represents the psychological process of acquiring and remembering information. Most tasks require that students recognize or remember key facts, definitions, concepts, rules, and principles. To recall information, students need most often to rehearse or practice it, and then to associate it with other, related concepts. The Recall category includes knowledge and comprehension, categories found in Bloom's Taxonomy of cognition.

Analysis

When students analyze, they divide a whole into component elements. Generally the different part/whole relationships and the parts of cause/effect relationships that characterize knowledge within subject domains are essential components of more complex tasks. Similarly, Bloom defines analysis as: breaking down learned information into parts so that the relationship between smaller elements is clear.

Comparison

Comparison tasks require students to recognize or explain similarities and differences. Simple comparisons require attention to one or a few very obvious attributes or component processes, while complex comparisons require identification of the differentiation among many attributes or component actions. In order to accomplish comparisons, one must use the cognitive process of analysis; however, comparison goes beyond breaking the whole into parts in order to compare similarities and differences. This category subsumes some of Bloom's level of synthesis.

Inference

The processes of deductive and inductive reasoning are included in this category. In deductive tasks, students are given a generalization and are required to recognize or explain the evidence that relates to it. Applications of rules and "if then" relationships require inference. In inductive tasks, students are given the evidence or details and are required to come up with the generalization. Hypothesizing, predicting, concluding, and synthesizing all require students to relate and integrate information.

Evaluation

Using some criteria to make judgments about some material or method is known as evaluation. Evaluation depends on the logic of the thinking done at the previous levels of cognition. These tasks require students to judge quality, credibility, worth, or practicality. To evaluate, one must assemble and explain the interrelationship of evidence and reasons in support of conclusions drawn.

Creative Thinking

In addition to the above Thinking Processes, your unit should also encourage creative thinking. Creative thinking processes require a different type of thinking. It involves searching for alternatives or ideas that can be used to solve problems. A hallmark of this kind of thinking is its divergence, producing many ideas, unusual ideas, or different kinds of ideas. In order

to generate a number of ideas or quantity, one learns to use imagination and defer judgment of ideas to a later, more appropriate time.

Perkins (1984) highlights an important characteristic of creative thinking:

> *Creative thinking is thinking patterned in a way that tends to lead to creative results. This definition reminds us that the ultimate criterion for creativity is output. We call a person creative when that person consistently gets creative results, meaning, roughly speaking, original and otherwise appropriate results by the criteria of the domain in question.*

Fluency, flexibility, originality and elaboration are four basic abilities used in creative thinking processes. The following definitions have, in part, been supplied by Treffinger, et. al. (1985).

Fluency

Fluency is a memory process. A clue to use in searching for or developing curriculum in fluency is **quantity**. Each of us stores many bits of information over the years from our experiences both in and out of school. The ability to produce many ideas, to recall a lot of information pertinent to a given stimulus, is called fluency. Fluency is an important thinking process, since research has shown that the more fluent you are in your thinking, the more likely you are to produce quality ideas.

Flexibility

Flexibility is the ability to "switch gears" when thinking, to change classes or categories when producing ideas. A clue to flexibility is **classes.** Flexibility is the opposite of rigid thinking. Flexibility in thinking requires the ability to see a wide variety of applications to a particular concept, and the ability to adapt to alternative new situations and ideas. Flexibility is important in solving problems. A flexible thinker is able to view the problem from many angles.

Originality

Originality is the ability to produce new, unique, or unusual ideas. A clue to originality is **newness**. It is said that there is nothing new under the sun, and often original ideas are combinations, modifications, adaptations of one or more old ideas. Original ideas have an element of surprise.

Elaboration

The ability to think of related ideas to fill out an idea or concept is called elaboration. A clue to elaboration is **details**. This thinking process is important in producing plans of action and thinking of ways to implement chosen solutions to problems. It is also important in a search for facts about any problem, searching widely for details that may clarify a problem.

Step Four: Planning Prototype

The Planning Prototype is a tool to ensure that content will be covered while students are challenged to use all levels of cognition and employ creative thinking strategies when accomplishing the Interdisciplinary Unit. The Planning Prototype will be used to help the reader complete Steps Five through Seven. The Planning Prototype will help put it all together by providing a means to record the major content headings (Step Four), determine what thinking skills will be used (Step Five), write an appropriate objective for the content using the chosen thinking skill (Step Six), and determine a means for assessment (Step Seven).

Use the following steps and the Planning Prototype to accomplish Step Four.

- Enter each of the major headings of your Content Outline in the left column of the prototype. You may use any or all the content outline in this process, treating all entries as major headings. You will notice the thinking skills are listed along the top row of the prototype.

- The intersection of each row and column supplies the reader with a decision, which is whether or not to develop an objective for the content using the specified thinking skill. That is, "Can this thinking process be combined with this content area to describe some important learning for my students?"

- Place a small code mark in the corner of each cell to represent a combination you will include in your planning. If you are unsure place a question mark in the box, so you'll remember to work on it as you proceed.

- When you have completed this process you now have a plan for developing objectives for each marked box. It takes into account both the content of the unit and the student's thinking processes.

Planning Prototype Sheet

Directions:

1. Referring to the Content Outline place the major headings in the Planning Prototype Sheet. These major headings will become the basis for the development of the objectives, activities and assessment techniques.

2. In order to accomplish this task develop a code that works for you and place it in the corner of each cell you will include in your planning and for which you intend to write an objective. For example, consider 1R for the first major heading under recall, 6E for the sixth major heading under Evaluation, etc. In the box, then, you may wish to note that you will develop an objective in Science emphasizing fluency, and so forth.

3. Place a question mark in the box if you are considering its inclusion but are uncertain at this time as to what you will do, so you'll remember to work on it as you proceed.

Major Heading	Recall (R)	Analysis(A)	Comparison (C)	Inference (I)	Evaluation (E)	Creativity (Cr)
1 Principles of Flight	1R Sc	1A				
2 Parts of an Airplane	2R Sc					2 Cr Fl Fx
3 Meteorology: Fronts	3R Sc	3A Ma		3I Sc		
4 Meteorology: Cloud Formations	4R Sc		4C s			
5 Meterology: Pressure systems	5R Sc	5A Sc				
6 Careers: Navigator		6A ss			6E La	
7 Types of Aircraft: Fighter		7A sc/Ma	7C ss			
8 History of Aviation: Development of aviation: aircraft technology.				8I ss	8E SS	
9 Aerospace: Escape Velocity	9R Sc	9A Sc	9C Sc	9I Ma		

Science (Sc), Math (Ma), Language Arts (La), Social Studies (SS), Art (A), Physical Education (PE), Music (Mu), etc.
Fluency (Fl), Flexibility (Fx), Originality (Or), and Elaboration (El)

Step Five: Instructional Objectives

Writing instructional objectives is an important and integral part of developing the Interdisciplinary Unit. Objectives have many values for the teacher as instructor, primary among them being to aid the teacher in determining whether the student has attained the knowledge. Objectives help you to determine what it is you want students to learn and, hence, what you want to measure, and suggest further how to measure what you want to measure, whether students have achieved what is intended, and areas in which your instruction has been successful and unsuccessful.

Kriege (1971) suggests that the teacher judge objectives against the following ten criteria:

- Written in terms of student performance.
- Observable by one or more of the five senses (or ninteen senses as listed by Bob Samples in his book, *Open Mind Whole Mind*, 1990).
- Specific enough to be meaningful.
- Valid in relation (i.e., relevant) to the major objective or goal.
- Measurable in terms of level of performance and conditions under which the performance is to take place.

- Sequential in relation to prior and subsequent objectives.
- Relevant to the student's experience.
- Attainable within the time period allotted.
- Challenging to each individual student.
- Acceptable to the societies of which the student is a member.

Planning the unit using objectives

The reader is referred back to the Planning Prototype on page 21. Filled in, this document becomes the important link between the content topics and how they can be combined with thinking processes. Once one knows which areas need to be covered in the unit, it then becomes necessary to develop objectives for each marked "cell" of the matrix. For each "cell" develop an instructional objective, design learning activities, and formulate assessment strategies.

Developing Instructional Objectives

The Planning Prototype becomes the basis for writing objectives. It is suggested that one begin by working on one topic at a time, and work across the process levels for that topic before proceeding to the next topic. Also, review the *meaning* of each of the thinking processes as you work on your objectives. Check your objectives to see if they describe student learning that is different at each of the thinking process levels in your prototype. In order to help you get started the following brief statement about each of the thinking processes is provided.

Thinking Process	Brief Statement
Recall	Recall objectives emphasize the student's ability to remember facts, specific information, or definitions.
Analysis	Analysis objectives emphasize determining the attributes or characteristics of a concept or problem, or comparing and contrasting alternatives.
Comparison	Comparison objectives emphasize determining or explaining similarities and differences.
Inference	Inference objectives ask the student to use both deductive and inductive reasoning.
Evaluation	Evaluation objectives deal with making judgments and decisions. They may build upon criteria that were developed through analysis objectives, or use external criteria developed by a group or another individual.
Creative Thinking	These objectives are open-ended and stress fluency, flexibility, originality, or elaboration in thinking.

Step Six:
Learning Activities

The next step in the process of developing a unit is to match *learning activities* with the *instructional objectives*. In this scenario a learning activity is anything done by a student - or a group of students - to enable them to attain an objective; (***It is what the students actually do***).

When writing the objectives for each topic or content you probably noticed that objectives for different thinking processes involved different kinds of activity or behavior by the students. This step will involve the reader in the development of learning activities for each of the objectives in your matrix. In doing so there are two important things to keep in mind as we begin this step:

- Students bring with them experience, maturity, skills and ability, and different learning modalities. Therefore, your unit can appeal to individual differences by planning several different activities for each specific objective. Bob Samples (1987) indicates that learning modalities are an expression of the design of the brain-mind system. All our learning modalities are linked to our senses. Samples places these modalities into five major categories: Symbolic-Abstract, Visual, Kinesthetic, Auditory and Synergic. Most education in the United States emphasizes the Symbolic-Abstract Modality.

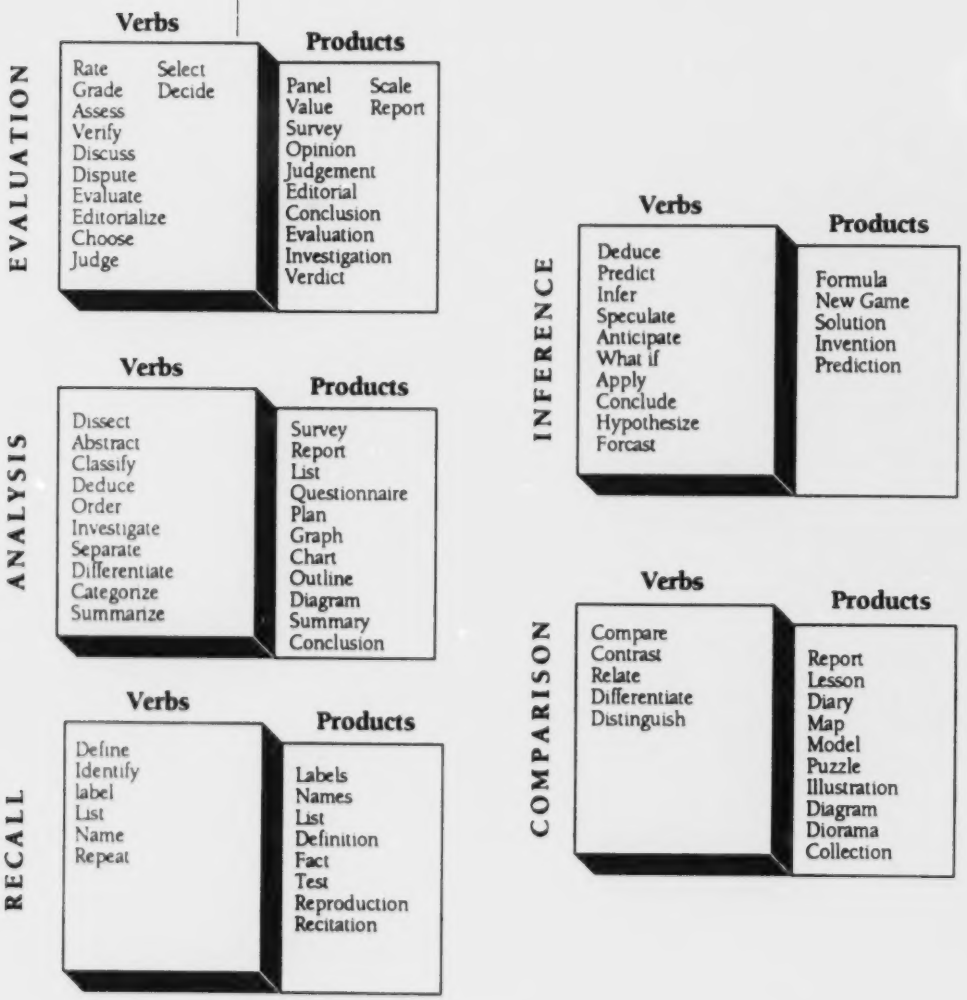
- Objectives planned for different thinking processes will also involve a variety of different activities. Some activities are particularly well suited for developing certain thinking processes.

- Group size is an important consideration when designing learning activities. The reader may wish to use the following guidelines when considering group size for each activity.

Activity	Group Size
Individual performance, evaluation or conference	One
Personal feedback from another student (i.e., writing response partner)	Two
Specific task such as library research on a group selected topic; brainstorming activities	Three to Five
Issue oriented discussion	Four to Seven
Debates, role–playing or simulations	Half the class
Rapid transmission of information such as lectures, videos, etc.	Entire Class

On the next page is a list of different kinds of learning activities, classified according to the thinking processes for which they may be most effectively used. On the page following the Build a Higher Thought you will find the Instructional Objectives & Activities Worksheet.

Build a Higher Thought



Instructional Objectives & Activities Worksheet

Using the code developed in the Planning Prototype place the code in the Code column and then write an instructional objective. Once this is accomplished provide a description of the activity you plan to use to teach the objective. Remember that it is instructionally prudent to include activities that emphasize different learning modalities.

Code	Instructional Objectives	Planned Activity	Class Size
1R / Sc	Given a picture of an airplane, the student will **label** the forces involved in flying.	The initial class will be shown a large chart with an airplane depicted, with the forces labeled. Students will learn to identify the forces.	3–5
2 Cr / Fl/Fx	Describe a different type of material that could be used in construction of an aircraft.	The group will brainstorm a list of possible materials that could be used to build a flying machine. They will then select one material and describe its use in building the craft.	3–5
3I / Sc	Given a weather front and geographic conditions, **predict** what type of weather the area will experience.	Disscussion of weather fronts and movies shown will be **reviewed**. Based upon this data, students will be given novel (to them) situations and will predict weather conditions.	4–7
6A / SS	Given the functions of a navigator students will **investigate** what types of knowledge and schooling are necessary to become an airplane navigator.	Library research will be accomplished as well as interviews of military and commercial airline navigators.	3–5
7A / Sc/Ma	Given pictures of airplanes, students will categorize them according to function.	From a large collection of airplane pictures, students working in groups will develop a naming system and method of categorization.	3–5
7A / Sc	Given a bomber and fighter, list similarities and differences.	Groups of students will be given one model each of a bomber and fighter—preferrably of different kinds for each group. Each group will compare their model planes after which groups will compare lists.	3–5
9I / Ma	Given the constants of gravitational pull thrust and aerodynamics, the student will predict what will occur if the gravitational pull were to increase.	For different size planets, gravitational pulls will be given. The student will develop a formula for escape velocity. Once determined they will predict changes in velocity based upon gravitational pull.	3–5

Step Seven: Measurement Procedures

Your Interdisciplinary Unit has been "growing" steadily since we began with a simple content outline. By now, you should have a complete set of written objectives and a variety of learning activities, incorporating many different thinking processes. The final task, then, is to take each cell in the planning prototype for your unit and ask:

- *How will I determine whether the student has completed this objective successfully?*
- *What kinds of evidence would be most useful?*
- *What criteria should be used to determine how well s/he did?*

The final step in the development of the Interdisciplinary Unit is the measurement procedure. "How does one know that a student has acquired the objective?" Remember an effective instructional unit must include, for each objective, a measurement criterion and a statement of how the measurement will result. Although tests may be useful in determining a student's success in completing a certain objective (particularly at the Recall level), it is not necessarily the case that measurement always include testing. According to Rick Stiggins (1990), determining whether a student knows the material can be measured in three ways: Observation of performance, oral feedback or paper and pencil tests. Since students differ on the way they prefer to give feedback it is recommended that all three means be employed to receive measurement feedback.

Measurement, as the term is applied here, refers to any appropriate evidence that you can obtain to determine whether the student has learned a certain objective. How do you gather this "evidence"? How will you decide when a student has met an objective? The following suggestions may help in planning and conducting your measurement strategies.

- Ensure that your measurement procedure is in agreement with your objective. When checking for this agreement, two criteria must be met. First, the measurement must deal with the content of the objective. Second, it must use the appropriate thinking process asked for in the objective. For example, if the objective calls for inference, the measurement procedure should ask the student to demonstrate the ability to infer.

- It was stated earlier that it is important that the student is aware of the objectives of the Interdisciplinary Unit. This way s/he knows what is expected. Similarly, if one has an expectation about the standards that must be met by the student in completing the objective, that expectation should be clearly stated to the student in advance.

- Ensure that the standards for judgement for grading student work are both fair and appropriate for the objective.

- Finally, work with the students to define the measurement criteria, and to help them understand what kinds of work will or will not meet the criteria. If you wish to emphasize speed (or completing work within a certain time period), or accuracy (doing work carefully and correctly with less emphasis on time) or quality (the inclusion by the students of certain "key" requirements for an acceptable responses), you should discuss your expectations and criteria specifically with the students. (Treffinger, 1979)

Assessment Planning Chart*

Grade Level 7/8 Subject "Touch and Goes" Topic Airplanes

Code	Oral	Test	Performance
1 1R / Sc.		On the picture provided, label the forces involved in flying.	
2 2R / Sc.	Using a model students will indicate where each part of the plane is located.		
3 3I		A warm front from the ocean approaches the mountains. Temperature is 32°f. What type of weather will occur a. rain b. snow c. clear sky d. tornado	
4 6A / Sc.		You have investigated what types of schooling and knowledge are necessary to become an airplane navigator. What are the basic knowledge and schooling needed for a space navigator?	
5 7A / Sc./M		Consider the vertical take off and landing aircraft. How do you categorize it and what design features allow it to function as designed?	
6 7C / Sc.	Differentiate between cargo aircraft and helicopters.		
7 9I / M		Calculate the escape velocity given a gravitational pull of 64 ft/sec.	
8 ___			
9 ___			
10 ___			

*This chart is adopted from the Northwest Regional Educational Laboratory's Classroom Assessment Training Program, Richard J. Stiggins, February 1990.

Appendix A: Timeline and Worksheets

Although it is possible to produce an interdisciplinary unit in a relatively short time, it is advantageous to provide sufficient time to ensure that it is well thought out. The suggested timeline outlined below is written for a classroom teacher. You may be able to accomplish the task in shorter time, but given a teacher's many classroom responsibilities, a shorter timeframe, in most instances, may be unrealistic. With each succeeding unit this suggested timeline can be adjusted to accommodate the writer's increased awareness of the required processes.

Step	Event	Time
STEP ONE	Concept Outline	3 weeks
STEP TWO	Content Outline	3 weeks
STEP THREE	Thinking Processes	3 weeks
STEP FOUR	Planning Prototype	3 weeks
STEP FIVE	Instructional Objectives	4 weeks
STEP SIX	Learning Activities	6 weeks
STEP SEVEN	Measurement Procedures	3 weeks
	Conduct Interdisciplinary Unit	Varies

Concept Outline

Title _____

Question: _____

Areas of Study

_____
_____
_____
_____
_____
_____
_____
_____

Methods

_____
_____
_____
_____
_____

End Products

_____
_____
_____
_____
_____
_____

Content Outline

Title_____

I. _____

A. _____

1. _____
2. _____
3. _____
4. _____

B. _____

C. _____

D. _____

II. _____

A. _____

1. _____
2. _____
3. _____
4. _____

B. _____

C. _____

D. _____

III. _____

A. _____

1. _____
2. _____
3. _____
4. _____

B. _____

C. _____

D. _____

Planning Prototype Sheet

Directions:

1. Referring to the Content Outline place the major headings in the Planning Prototype Sheet. These major headings will become the basis for the development of the objectives, activities and assessment techniques.

2. In order to accomplish this task develop a code that works for you and place it in the corner of each cell you will include in your planning and for which you intend to write an objective. For example, consider 1R for the first major heading under recall, 6E for the sixth major heading under Evaluation, etc. In the box, then, you may wish to note that you will develop an objective in Science emphasizing fluency, and so forth.

3. Place a question mark in the box if you are considering its inclusion but are uncertain at this time as to what you will do, so you'll remember to work on it as you proceed.

Major Heading	Recall (R)	Analysis(A)	Comparison (C)	Inference (I)	Evaluation (E)	Creativity (Cr)
___						
___						
___						
___						
___						
___						
___						
___						
___						

Planning Prototype Sheet

Continued

Major Heading	Recall (R)	Analysis(A)	Comparison (C)	Inference (I)	Evaluation (E)	Creativity (Cr)
___						
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Instructional Objectives & Activities Worksheet

Using the code developed in the Planning Prototype place the code in the Code column and then write an instructional objective. Once this is accomplished provide a description of the activity you plan to use to teach the objective. Remember that it is instructionally prudent to include activities that emphasize different learning modalities.

Code	Instructional Objectives	Planned Activity	Group Size
____			
____			
____			
____			
____			
____			
____			

Assessment Planning Chart*

Grade Level _____ Subject _____ Topic _____

Code	Oral	Test	Performance
1 ___			
2 ___			
3 ___			
4 ___			
5 ___			
6 ___			
7 ___			
8 ___			
9 ___			
10 ___			

*This chart is adopted from the Northwest Regional Educational Laboratory's Classroom Assessment Training Program, Richard J. Stiggins, February 1990.

Appendix B: Unit Samples

The following samples were submitted and selected as examples for interdisciplinary unit development. They are:

- "Corn, It's A–MAIZ–ING" by **Patricia McRae** from Cantwell School; and
- "Wolves" by **David and Marylee Bates** from Akiak School

Concept Outline

Title "Corn It's A-MAIZE-ING !"

Question: Why is corn so important and useful?

Areas of Study

- History of corn
- Importance of corn as an agricultural product
- Where corn is grown
- How corn and corn by-products are used
- Different kinds of corn
- Characteristics of corn and corn products
- Corn as a word - a phonetic study of r-controlled vowels/words

Methods

- Readings and discussions
- Graphing
- Map study
- Cooking
- Experimentation with corn seeds, corn products, corn growth
- Brainstorming
- Writing

End Products

- Live Report (preferably videotaped)
- Class poetry
- Individual writings
- Individual drawings
- Baked corn products
- Corn art (corn husk wreath)
- Photos depicting cooking sequences
- Living corn plants
- Log of corn plant growth
- Bound book of entire corn project

Content Outline

Title "Corn It's A-MAIZE-ING !"

I. PARTS OF A CORN PLANT

A. Stalk
   1. identify on photo
   2. label stalk on photo

B. Leaves
   1. identify on photo
   2. label leaves on photo

C. Tassels
   1. identify on photo
   2. label tassels on photo

D. Ear
   1. identify on photo
   2. each student receives individual ear of corn
   3. class description of characteristics of the ear

E. Husks
   1. identify on actual ear and then on photo
   2. discuss "husking" or cleaning corn
   3. students observe teacher husking an ear of corn
   4. students make predictions about how many husks will be on their ear of corn
   5. students husk corn
      a. record number of husks
      b. compare with prediction
   6. record their data on a class graph
      a. discuss results of class graph
      b. make individual graphs of class results
   7. class discussions of characteristics of the husks
   8. save husks for labeling and for later use

F. Silk
   1. identify on actual ear and photo
   2. discuss properties of silk
   3. set aside some silk to glue onto papers and label

G. Kernels
   1. identify on ear of corn
   2. describe in class discussion and brainstorm characteristics
   3. wash ear to prepare for cooking
      a. boil pot of water (review "temperature" and "boiling point")
   4. cook corn
   5. eat corn
      a. describe the differences between cooked and uncooked corn; color, texture, temperature
      b. describe the taste of the cooked corn - class brainstorm

H. Cob
   1. after corn has been eaten identify the cob
   2. describe characteristics of the cob in class brainstorm
   3. dry cobs for later use

II. WHERE CORN IS GROWN

A. Discuss Corn Yield Map of Lower 48 States
   1. identify major corn producing states
   2. locate and color on indi-

Content Outline

Title "Corn It's A-MAIZE-ING !"

vidual maps
3. discuss concept of "Heartland"

B. Discuss Corn Yield Graph of Lower 48 States
1. identify states on a bar graph
2. discuss bushels of corn grown in a year
3. make a classroom bar graph of the same type to enhance understanding of the corn yield bar graph

*for our data we went outside and picked up rocks for three minutes, brought them inside and placed them in groups of ten on large sheets of paper - then the children traveled from sheet to sheet with graph paper and stickers and graphed each other's rocks each sticker representing a group of ten rocks

III. USES OF CORN

A. Read "Corn is Maize" by Aliki
1. discuss what the children learned from the book
   a. something they never learned before
   b. their favorite part of the book
   c. application to their lives
2. children report on "Corn is Maize"
   a. orally with teacher/ group
   b. individually, in writing or orally on tape
   c. a group "live" report in which children act out their choice for the most important fact of the book or what they learned about corn. (Ideally this is video-taped)

B. Study of Corn Products Used in Daily Lives of Students
1. students/teachers bring corn products to school, such as...
   a. corn meal
   b. corn starch
   c. baby powder
   d. corn cereal(s)
   e. popcorn
   f. corn syrup
2. discuss characteristics of these corn products
   a. taste
   b. feel
   c. smell
   d. sight
   e. sound

C. Corn as Food
1. corn on the cob
   a. boiled
   b. roasted
2. canned corn
3. frozen corn
4. popcorn
   a. plain
   b. flavored
5. as an ingredient in other foods
   a. cereal

Content Outline

Title "Corn It's A-MAIZE-ING !"

- b. other foods found in supermarkets or at home
  - 1 muffins
  - 2 syrups

D. Use of Corn By-Products
- 1. livestock feed
  - a. field corn
  - b. silage
- 2. art
  - a. corn husk wreaths/ dolls
  - b. corn cob people
- 3. fuel
  - a. burn cobs as Native Americans did for fuel
  - b. ethanol/gasahol

IV. HISTORY OF CORN

A. Ancestry of Corn
- 1. what scientists know
  - a. Indians in central America used corn 10,000 years ago
  - b. discovery of 5,000 year old corn in a cave in Mexico
- 2. how Indians used corn
  - a. as a food
  - b. other uses of corn plant

B. Corn in North America
1. Indians taught colonists in 1600's to grow corn
2. in 1800's corn became a major commercial crop

V. HOW CORN IS GROWN

A. Students Learn about Corn Growth
- 1. students plant their own corn
  - a. sweet corn
  - b. ornamental corn
  - c. popcorn
- 2. students learn about associated concepts
  - a. sowing
  - b. germination
  - c. pollination
  - d. harvesting
- 3. students become familiar with information on seed packets

B. Students Keep a Log of the Growth of Corn Plants
- 1. students care for plants
  - a. water
  - b. light
- 2. students record growth of plants
  - a. measure
  - b. record growth on daily log

VI. EXPERIMENTATION WITH CORN

A. Questions: Do edible popcorn seeds grow? Does decorative corn grow?
- 1. class members make hypothesis
- 2. class members record hypothesis

B. Class Attempts to Germinate and Grow Edible Popcorn and Decorative "Indian" Corn
- 1. germinates the above
- 2. plants the above
- 3. records success or failure of growth

Content Outline

Title "Corn It's A-MAIZE-ING !"

4. compares results with hypothesis

VII. STUDY OF THE WORD "CORN"

A. Class Discussion of "or" as an R-Controlled Syllable
   1. class brainstorm of "or" words
   2. class writings of these words in sentences
   3. class readings of peer writings
   4. student generated "or" sentences used for hand-writing practice for whole class

B. Class Discussion of Other R-Controlled Vowels
   1. class brainstorm of "ar", "er", "ir", and "ur" words
   2. class writings of these words in sentences
   3. class readings of peer writings
   4. student generated r-controlled vowel writings used for handwriting practice for whole class

VIII. WRITING ABOUT CORN

A. Student Brainstorms of Activities Used as Basis for Writing Activities
   1. description of corn
      a. students use adjectives to describe the different parts of a corn plant and ear of corn
      b. create a class poem about corn using adjectives and nouns

B. Cooking, Planting, Graphing, etc.
   1. students use class brainstorms to write about the different activities and experiences
   2. students create a class book of corn experiences

Planning Prototype Sheet

Directions:

1. Referring to the Content Outline place the major headings in the Planning Prototype Sheet. These major headings will become the basis for the development of the objectives, activities and assessment techniques.

2. In order to accomplish this task develop a code that works for you and place it in the corner of each cell you will include in your planning and for which you intend to write an objective. For example, consider 1R for the first major heading under recall, 6E for the sixth major heading under Evaluation, etc. In the box, then, you may wish to note that you will develop an objective in Science emphasizing fluency, and so forth.

3. Place a question mark in the box if you are considering its inclusion but are uncertain at this time as to what you will do, so you'll remember to work on it as you proceed.

	Major Heading	Recall (R)	Analysis(A)	Comparison (C)	Inference (I)	Evaluation (E)	Creativity (Cr)
1	Parts of a Corn Plant	1R La	1A La, Ma	1C A	1I Ma	1E La	
2	Where Corn is Grown	2R SS		2C Fx Ma	2I SS		
3	Uses of Corn		3AfI La/Home Ec.	3c La	3I La	3E SS La	
4	History of Corn	4R La, SS		4C Fx La, SS		4E FI SS, La	
5	How Corn is Grown	5R La	5A Fx S			5E S, La, M	
6	Experimentation with Corn				6I Fx S		
7	Study of the Word "Corn"	7R La	7RFI La	7C Or La			
8	Writing about Corn	8R FI La		8C FI La	8I FI La	8E EI La	

Instructional Objectives & Activities Worksheet

Using the code developed in the Planning Prototype place the code in the Code column and then write an instructional objective. Once this is accomplished provide a description of the activity you plan to use to teach the objective. Remember that it is instructionally prudent to include activities that emphasize different learning modalities.

Code	Instructional Objectives	Planned Activity	Group Size
1R / La	Given a picture of a corn plant the student will first receptively identify the various parts of a corn plant and secondly expressively label the parts.	Class will be shown a picture of a corn plant with the parts labeled. Students will learn the names of the parts of the corn plant in order to label these parts on individual pictures.	ALL
1I / Ma	Given an actual ear of corn, students will predict the number of husk on their ear, husk their corn and compare actual numbers to their prediction.	Each student will be given an ear of corn. Students will observe the teacher, predict, and then husk an ear of corn. Students will then predict and husk their own ear of corn and compare the two.	1
1A / Ma	Students will participate in entering the number of husks from their ears of corn on to a class graph.	Students will enter data onto class graphs and engage in discussion about the information that the graph provides. Students will reproduce class graphs for future use.	3–5
1R / La	Given an actual ear of corn, students will receptively and expressively identify the parts of the ear.	Students will glue corn silk and corn husks onto paper and label them.	1
IC / A	Given an actual ear of corn, students will create art from the husks.	Students will watch the teacher model making a corn husk wreath and then students will make their own wreaths.	ALL
1E / La	Given an actual ear of corn, students will evaluate and describe the husks, silk, kernels and cob.	Students will use all five senses to orally describe their corn. Teacher will record and save these descriptions.	1
2R / SS	Given a map of the US with major corn producing states highlighted, students will identify the major corn producing states.	Students will be shown a map of the US with the major corn producing states highlighted. On individual maps students will highlight/color these states.	1

Instructional Objectives & Activities Worksheet

Using the code developed in the Planning Prototype place the code in the Code column and then write an instructional objective. Once this is accomplished provide a description of the activity you plan to use to teach the objective. Remember that it is instructionally prudent to include activities that emphasize different learning modalities.

Code	Instructional Objectives	Planned Activity	Group Size
2C / Ma	Students will interpret a bar graph of the number of bushels of corn produced in the major corn producing states	Students will create a similar bar graph on a smaller scale. For data students will pick up rocks outside for 3 minutes. They will then group rocks into tens and create a bar graph similar to the corn bar graph and graph the rocks picked up in three minutes.	1
2I / SS	Given the topography, soil and climate conditons in the major corn producing states, students will speculate as to the reasons why these states make up the "Heartland" of the US.	Students in small groups will generate questions about growing conditions in the major corn producing states and will ask these questions of an expert (i.e., phone an Iowan farmer).	3-5
3A / La	Students will read/listen to the book *Corn is Maize* by Aliki and will brainstorm most relevant parts of the book together.	In small groups, students will share what they feel to be most important/relevant parts of the book. These observations will be tape recorded.	3-5
3I / La A	After becoming familiar with *Corn is Maize*, students will write and/or illustrate: 1) something they never knew before, 2) their favorite part of the book, 3) something useful in terms of their lives.	Students will complete a book report, written and/or illustrated and will give an oral report on it to the class.	1
3E / SS La	After listening to class reports and reviewing class brainstorming of *Corn is Maize*, each student will choose a major category to report on for a LIVE book report.	Students design script and costume and will enact their choice of the most important part of *Corn is Maize* in a live book report to be videotaped.	4-7
3C / La	Given a variety of unlabeled corn products—corn starch, baby powder, corn meal and corn cereal, students will feel, taste, smell, look at and listen to these products.	Corn products will be spread on large papers on the floor so that students can experience them. Students will orally identify the characteristics of the products (to be recorded by the teacher) and will save a sample of each and label.	ALL
____			

Instructional Objectives & Activities Worksheet

Using the code developed in the Planning Prototype place the code in the Code column and then write an instructional objective. Once this is accomplished provide a description of the activity you plan to use to teach the objective. Remember that it is instructionally prudent to include activities that emphasize different learning modalities.

Code	Instructional Objectives	Planned Activity	Group Size
3A Home Ec	Students will participate in cooking a variety of Corn products including corn on the cob and corn muffins.	Corn on the cob and corn bread muffins will be prepared and eaten. Teacher will take Polaroid photos of major steps for use by studetns in review and sequencing activities.	ALL
3R La	Students will define vocabulary associated with cooking.	Discussion of key vocabulary words and concepts: pre-heat, boil, temperature, yield, ingredients, utensils, timing.	ALL
4R La SS	Students will list facts they have learned about the history of corn and the importance of corn in Native American culture.	In large groups, students will brainstorm (teacher recording) write and draw details of the importance of corn in Native American cultures.	4-7
4C La SS	Students will compare and contrast uses of corn in past to uses of corn today.	Students will listen to guest speaker talk about importance of corn in Native American culture. Students will watch a video about the importance of corn as a major US crop.	ALL
4E SS La	Students will evaluate the importance of corn in Native American culture and success of the colonists in North America.	Students will reinact scenes between Native Americans and colonists in sharing of corn as a resource.	ALL
5R La	Given a variety of seed packets (photocopied), students will identify key vocabulary concepts associated with growing corn.	Given copies of seed packets and class discussion, studetns will learn the terms germination, sowing, pollination, harvesting.	ALL
5A S	Given a variety of seeds and information from seed packets, students will deduce optimum growing conditions for corn plants	Students will be given copies of seed packets and will become familiar with reading the information and interpreting the information. Students will use this information to plant their own corn.	ALL

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Instructional Objectives & Activities Worksheet

Using the code developed in the Planning Prototype place the code in the Code column and then write an instructional objective. Once this is accomplished provide a description of the activity you plan to use to teach the objective. Remember that it is instructionally prudent to include activities that emphasize different learning modalities.

Code	Instructional Objectives	Planned Activity	Group Size
5E / S, M / La	Students will evaluate the growth of their corn plants on a daily basis.	Students will measure and record the growth of their corn plant(s) on a daily basis, entering data onto a "corn log".	1
6I / S	Given the question "Does popcorn that we eat grow?", students hypothesize as to whether or not edible popcorn seeds will grow.	Group discussion of the term "hypothesis" preceeds students' actual hypothesis and is recorded. Edible popcorn is then planted and put in the same condition as seed corn.	1
6E / S / La	Students evaluate the growth of the experimental corn. When possible, students make/discuss conclusions about the experiment.	Students keep a log of the growth/non growth of experimental corn. when experimentl is complete, students discuss their conclusions and compare to their original hypotheses'.	1
7R / La	Given the rule for "or" words, students list all of the "or" words they can.	Teacher records on board as students list "or" words.	ALL
7A / La	Given the brainstormed list of "or" words, students write sentences using these words.	Using class brainstorming, students create original writings using as many "or" words as possible	ALL
7R / La	Given the rule for other r-controlled vowels, students orally list "ar", "ir", "er", and "ur" words.	Teacher records these words on board as students list "ar", "ir", "er", and "ur" words.	ALL
7A / La	Given the brainstormed list of r-controlled vowel words, students write sentences using these words.	Using class brainstorming, students create original writing using as many r-controlled vowel words as possible.	ALL

Instructional Objectives & Activities Worksheet

Using the code developed in the Planning Prototype place the code in the Code column and then write an instructional objective. Once this is accomplished provide a description of the activity you plan to use to teach the objective. Remember that it is instructionally prudent to include activities that emphasize different learning modalities.

Code	Instructional Objectives	Planned Activity	Group Size
7C / La	Given lists of brainstormed r-controlling vowel words, students compare and contrast the sounds of "ar", "ir", "er", and "ur".	Students use pre-arranged noises (i.e., clap or "or", whistle for "er" and "ur" and snap for "ar") to signify r-controlled words they hear as their classmates read what they've written.	ALL
8R / La	Given the class brainstorm of the characteristics of the parts of corn the experienced with all 5 senses, students list adjectives to describe those parts.	Students create class poem using their adjectives and nouns (i.e., big, curled up, green, dried-up, yellow, curly, crispy, ridged, splintery husks).	ALL
8C / La	Given the class brainstorms about the students' various experiences with corn, students relate (in writing) their thoughts and remembrances of those experiences.	Using the writing process, students choose the most personally interesting experiences from corn unit to write about.	ALL
8E / La	Using their saved, recorded, written, grown, drawn, logged products, students arrange and evaluate to create a book.	Students use the information they've accumulated to create their own book about corn. Students create a title for the book.	ALL
____			
____			
____			

Assessment Planning Chart*

Grade Level 1,2,3 Subject Corn Topic Corn, It's A-MAIZE-ING

Code	Oral	Test	Performance
1 1R / La		Students will label parts of a corn plant on a photo and on an actual ear.	Students will save this information for future use.
2 1A / Ma	Students will interpret the class graph of corn husks.		
3 1E / A	Students will orally identify major corn producing states on an US map.		
4 2R / SS	Using a bar graph of # of bushels of corn produced in US, students will identify states in 1,2,3 order.		
5 2C / Ma			Students will produce a similar but smaller scale bar graph using their own data.
6 2C / Ma	Students will list at least 3 reasons as to why the major corn producing states are such.	Students will interpret and read the information from the bar graph they constructed.	
7 2I / SS	Students will identify pertinent information from *Corn is Maize.*		
8 3A / La			Oral, written and live book reports of *Corn is Maize.*
9 3C / La		Students will differentiate between corn starch, baby powder and corn meal.	Students will use their senses to describe characteristics of these corn products.
10			

*This chart is adopted from the Northwest Regional Educational Laboratory's Classroom Assessment Training Program, Richard J. Stiggins, February 1990.

Assessment Planning Chart*

Grade Level 1,2,3 Subject Corn Topic Corn, It's A-MAIZE-ING

Code	Oral	Test	Performance
1 3A / Home Ec		Students will sequence pictures of cornbread muffin cooking experience.	Chronologically sequenced pictures glued and saved for future use.
2 3R / Home Ec	Students will demonstrate understanding of "pre-heat" and "temperature setting" in cooking.		
3 4R / SS La		Ancient corn was discovered in a Mexican cave by scientists. The age of the corn was 1) 100 years old 2) 500 years old 3) 5000 years old.	
4 4C / SS La	Fill in the blank. "Corn today is the same as corn in 1500 because . . . It's different because . . ."		
5 4E / SS La	Students define the role of Native Americans in teaching the colonist about corn.		Student reinactment of a scene depicting this sharing.
6 6A / S	Students define optimum conditions for growing corn.		Students plant corn. Students keep a log of corn growth.
7 6R / La	Students orally define germination, sowing, pollination and harvesting.		
8 6I / S	Students orally hypothesize about whether edible popcorn will grow.		Students plant and care for popcorn. Students keep log of experimental corn growth.
9			
10			

*This chart is adopted from the Northwest Regional Educational Laboratory's Classroom Assessment Training Program, Richard J. Stiggins, February 1990.

Assessment Planning Chart*

Grade Level 1,2,3 Subject Corn Topic Corn, It's A-MAIZE-ING

Code	Oral	Test	Performance
1 7R / La	Students list "or" words		
2 7A / La		Students use "or" words in original sentences.	Written sentences containing "or" words.
3 7R / La	Students list "ar", "ir", "ur" and "er" words		
4 7A / La		Students use r-controlled vowel words in original sentences.	Written sentences containing "or", "ar", "ir", "er" and "ur" words
5 7C / La	Students differentiate between sounds of r-controlled vowel words		Categorization activity.
6 8R / La	Students differentiate between describing words and naming words i.e. parts of corn.		
7 8C / La		Students use class brainstorms and data to write about corn experiences.	Class poem
8 8E / La	Students discuss and relate the most meaningful experiences they had in the corn unit.		Class book created and reproduced so every class member has a copy of corn activities.
9 ___			
10 ___			

*This chart is adopted from the Northwest Regional Educational Laboratory's Classroom Assessment Training Program, Richard J. Stiggins, February 1990.

Concept Outline

Title "Wolves"

Question: _____

Areas of Study

- The wolf's physical structure and abilities
- Types of wolves and habitat
- Social habits of the pack
- Future of the wolf
- Preditor/prey relationships
- Wolves portrayed in literature

Methods

Readings and dicussions	Games
Research and reports	Cooperative group work
Presenters	
Sculpting	
Drawings	

End Products

- Written Report
- Oral Presentation
- Response Journals
- Diorama of Clay Structures
- Comparison Paper
- Pre– and post–information chart

Content Outline

Title "Wolves"

I. THE WOLF'S PHYSICAL STRUCTURE AND ABILITIES

- A. Size
- B. Fur color
- C. Teeth
- D. Hearing
- E. Feet and Endurance

II. HISTORY OF THE WOLF

- A. Evolution
  - 1. Types of wolves
    - a. Timber wolf
    - b. Real wolf
    - c. Arctic wolf
- B. Past and present range

III. SOCIAL HABITS OF THE PACK AND FAMILY

- A. Size
- B. Rank
- C. Use of Ears
- D. Use of tail
- E. Hunting
- F. Raising Young

IV. FUTURE OF THE WOLF

- A. Population and range
- B. Management
  - 1. Trapping
  - 2. Poisoning
  - 3. Shooting
- C. Attitudes

V. ELEMENTS OF HABITAT

- A. Food and water
- B. Shelter
- C. Space
- D. Arrangement

VI. WOLVES PORTRAYED IN LITERATURE

- A. Contempory realistic fiction
- B. Historical fiction
- C. Traditional literature
- D. Information books

Planning Prototype Sheet

Directions:

1. Referring to the Content Outline place the major headings in the Planning Prototype Sheet. These major headings will become the basis for the development of the objectives, activities and assessment techniques.

2. In order to accomplish this task develop a code that works for you and place it in the corner of each cell you will include in your planning and for which you intend to write an objective. For example, consider 1R for the first major heading under recall, 6E for the sixth major heading under Evaluation, etc. In the box, then, you may wish to note that you will develop an objective in Science emphasizing fluency, and so forth.

3. Place a question mark in the box if you are considering its inclusion but are uncertain at this time as to what you will do, so you'll remember to work on it as you proceed.

	Major Heading	Recall (R)	Analysis(A)	Comparison (C)	Inference (I)	Evaluation (E)	Creativity (Cr)
1	Wolf's physical structure	1R SC		1C Art			
2	History of the wolf	2R SC	2A LA				
3	Social habits of pack/family	3R SC	3A LA	3C P.E.			
4	Future of the wolf	4R SC	4A LA			4E SC	
5	Elements of habitat	5R SC		5C P.E.			
6	Wolves portrayed in literature	6R Art		6C LA	6I LA	6E LA	

Instructional Objectives & Activities Worksheet

Using the code developed in the Planning Prototype place the code in the Code column and then write an instructional objective. Once this is accomplished provide a description of the activity you plan to use to teach the objective. Remember that it is instructionally prudent to include activities that emphasize different learning modalities.

Code	Instructional Objectives	Planned Activity	Group Size
1R / Science	Given article about the wolf's physical structure, students will record and list that information according to the worksheet.	Entire class reads article from wolves–zoobooks and completes worksheets.	ALL
1C / Art	Given clay, students will apply knowledge of physical characteristics to model forms of wolves.	Sculpt wolves from clay to be put into class diorama.	ALL
2R,3R / 4A Lang Arts	After the completion of the report, each group will give an oral report reciting information about their topic.	Oral presentations by cooperative groups	3–5
2A, 3A / 4A Lang Arts	Given the article, students working in small groups will write a page report summarizing information about their topic.	Divide class into cooperating groups. Have each group write a report using different information, i.e., history, social habits, future of wolves.	3–5
3C / PE	After playing game, students will define the terms predator and prey and adaptation.	Play Quick Frozen Critters pg. 105 or The Thicket Game, Pg. 95 from Project Wild.	ALL
4E / S/Sc	After the lecture, students will participate by formulating their own opinion and discussing it with others.	Guest speakers: Fish and Game Department, local trapper.	ALL
5R / S	After the lecture and given paper and crayons, students will apply knowledge by illustrating a picture including all elements of habitat.	Lecture about elements of habitat, food, water, shelter, space and arrangement.	ALL

Instructional Objectives & Activities Worksheet

Using the code developed in the Planning Prototype place the code in the Code column and then write an instructional objective. Once this is accomplished provide a description of the activity you plan to use to teach the objective. Remember that it is instructionally prudent to include activities that emphasize different learning modalities.

Code	Instructional Objectives	Planned Activity	Group Size
5C PE	After game *Shrinking Habitat*, students will describe effects of human development of land on animals and plants.	Play variation of *Shrinking Habitat* on page 182 of Project Wild.	ALL
6R Art	Given selected readings, students will recall the passage and illustrate to the best of their ability.	Read a selected section from literature. Allow studetns to illustrate it.	1
6C Lang Arts	Given the two versions, students will compare and contrast in writing the 2 stories.	Read aloud to class *Lon Po Po* and *Little Red Riding Hood*. Write comparisons.	ALL
6I Lang Arts	Given books and alloted time, students will have opportunity to read about wolves in fiction.	Uninterrupted silent reading of literature groups.	ALL
6E Lang Arts	Given time to read, students will express opinions by responding to a daily question in their response journals and participate in literary discussion.	Literature group. Discussion and response journals.	3–5

Assessment Planning Chart*

Grade Level 4-6 Subject _____ Topic Wolves

Code	Oral	Test	Performance
1 1R / sc			Students will label and list the physical characteristics of the wolf.
2 1C / Art			Students will compare/contrast their sculpture to pictures and each others.
3 2R / 3R / 4R LA	Students will give oral reports with their cooperative groups.		
4 2A / 3A / 4A LA			Each group will provide 1 cooperatively written report.
5 3C / PE		Define the words predator and prey.	
6 4E / S/Sc	Students will assess and evaluate the use of game management and trapping on the wolf population.		
7 5R / S/Art		Draw a picture including all elements of habitat for a wolf.	
8 5C / S		List 3 animals or plants that once lived in the area.	
9 6R / Art/LA	Students are to define their drawings in relation to the reading selection.		
10 ___			

*This chart is adopted from the Northwest Regional Educational Laboratory's Classroom Assessment Training Program, Richard J. Stiggins, February 1990.

Assessment Planning Chart*

Grade Level 4-6 Subject _____ Topic Wolves

Code	Oral	Test	Performance
1 6C / LA			Students will write a comparison paper of the 2 Red Riding Hood stories.
2 6I / LA	Students will make predictions about their books as they read.		Response Journals will be evaluated according to studetns ability and book chosen.
3 6E / LA			
4 ___		Pre/post information chart: What do you know about wolves? What kind of characters do they play in stories?	
5 ___			
6 ___			
7 ___			
8 ___			
9 ___			
10 ___			

*This chart is adopted from the Northwest Regional Educational Laboratory's Classroom Assessment Training Program, Richard J. Stiggins, February 1990.

Appendix C:
Program Support

Support for Interdisciplinary Education is provided by the Alaska Department of Education.

Department of Education Curriculum, Instruction and Assessment Contacts

Computers/Educational Technology
Cathy Carney, 465-2841
Lois Stiegemeier, 465-2644
Donna Ostrowski-Cooley, 465-2644

Model Programs
National Diffusion Network
Merits
Promising Practices
Sandra Berry, 465-2841

Data Management
Bob Silverman, 465-2865

Fine Arts
Judith Entwife, 465-2841

World Language
Multicultural Programs
Mike Travis, 465-2970

Health and Physical Education
Helen Mehrkens, 465-2841

Early Childhood Education
Kathi Wineman, 465-2841
Jean Ann Alter, 465-2841

Language Arts/Reading
Alaska State Writing Consortium
Judith Entwife, 465-2841

Mathematics
Cathy Carney, 465-2841

Science
Peggy Cowan, 465-2841
Mining and Minerals
Terri Campbell, 465-2841

Regulations/Accreditation
Darby Anderson, 465-2841

Social Studies
Marjorie Gorsuch, 465-2841

Vocational Education
Karen Ryals, 465-4685

1991 MERITS Awards

These districts have recorded their involvement with interdisciplinary practices and programs by applying for recognition in the Department of Education MERITS (Many Educational Resource Ideas To Share) program.

Program	Contact Information
Kindergarten Fish Camp Unit	Michael E. Murray Mikelnguut Elitnaurviat School Lower Kuskokwim School District
Aluminum Can Recycle Unit	Lynda Evans Pilot Station School Lower Yukon School District
Heritage Discovery Week (1300-1650 AD)	Lance V. Packer Blatchley Middle School Sitka School District
Interdisciplinary Literature Units for fifth graders	Susan Hanson Gastineau Elementary School Juneau School District
Entrepreneurship in a secondary school	Jim Moras and Todd Bergman "Chief" Ivan Blunka School Southwest Region School District
Inter-disciplinary Teaching: developing "Block of Time" schedules	Jim Moras Southwest Region School District
"Alaska Month"	Janice Hall North Star Elementary Kenai Peninsula School District
Touch and Goes: aviation for middle schoolers	Kathy Hill and Wayne Clark Homer Junior High School Kenai Peninsula School District
Bering's Journey: Alaskan history for fifth grade	Gary VanHooser and Margaret Corbisier Chapman School Kenai Peninsula School District
Student-Originated Story Problems	Kay Smith William H. Seward Elementary Kenai Peninsula School District
We Are Thankful	Jolee Ellis and Diane Borgman McNeil Canyon Elementary School Kenai Peninsula School District
Interdisciplinary Unit for the Middle East Conflict	Dennis Stovall Clark Jr. High School Anchorage School District

Teacher Incentive Grants

Each year, the Department of Education awards a number of Teacher Incentive Grants, funded through federal Chapter II money. In 1990, several of these went to interdisciplinary projects. Below are listed the titles of these projects with contact information

Program	Contact Information
Interdisciplinary Film Study	Bristol Bay (Pam Krepel)
An Interdisciplinary approach to weather and the fourth grade curriculum	Kenai (William Noomah)
Africa: An Interdisciplinary Unit: Folktales to Facts	Lower Yukon (Jean Stockburger)
Expanding Interdisciplinary Relationship between Science, Reading, and Language	Matanuska-Susitna (Carol Jo Lowery)
Cooking Across the Curriculum	Sitka (Kay McCarthy)

Department of Education Interdisciplinary Programs

Program directors at the Department of Education maintain an interdisciplinary focus in all their activities. A few of the programs which focus directly on making connections across the curriculum are listed below.

Program	Contact Information
Alaska Minerals and Energy Resource Education Fund Coordinator	Terri Campbell
Science, Technology, and Society (STS)—A cadre of trainers promoting connections among these sectors	Peggy Cowan
Alaska Geographic Alliance: Institute and curricular activities involve K-12 teachers and are interdisciplinary	Marge Gorsuch
Educational Partnerships Conference: A conference devoted to making connections across the curriculum. Held every other year in Anchorage, with the next conference scheduled November 12–14, 1992.	Sandra Berry
Development of Model Curriculum Frameworks, stressing the incorporation of interdisciplinary activities across the curriculum.	Darby Anderson

National Diffusion Network
Interdisciplinary Training Opportunities

Below are examples of interdisciplinary projects found in the National Diffusion Network which have been implemented in Alaska. For further information on these projects, or guidelines on obtaining National Diffusion Network training, contact Sandra Berry at the Alaska Department of Education.

- Science, Technology, and Society: Preparing for tomorrow's world
- Marine Science: For Sea
- Hands-on Elementary Science
- Teaching Geography: A Model for Action
- Reading Education Accountability Design: Secondary (READ:S)
- Institute for Creative Education (ICE)
- CERES: Career Education Responsive to every student
- Growing Healthy

Status Report

In May, 1990, as part of its annual survey, the Department of Education asked all school districts, "Do you have any interdisciplinary practices/programs which are working in Alaska?"

Twenty-one districts said, "Yes." The program descriptions supplied by those school districts are listed below.

Program	Contact Information
Mentor Program, block schedules, shared time staffing	Alaska Gateway
	Aleutian Region
All schools have many programs	Aleutians East
A variety of programs	Anchorage
Team planning, cross-curriculum	Annette Island
More focus on implementation of language and manipulatives in mathematics	Chugach
Integration of cultural programs in regular classrooms	Dillingham
Senior seminar, applied food science, connections	Fairbanks
Extensive interdisciplinary activities	Hoonah
Language curriculum guide	Iditarod
Project 2000, team structures	Juneau
Theme/topic units	Kenai
"Plays R Us"	Kodiak Island
Interdisciplinary curriculum	Lower Yukon
Interdisciplinary curriculum	Matanuska-Susitna
Interdisciplinary activities, 4.5 days of inservice	Northwest Arctic
Entire curriculum is interdisciplinary	Saint Mary's
Contact Pat Stevens or Connie Ellingson 747-8672	Sitka
Writing/journalism	Southwest Region
	Tanana
Interdisciplinary program	Yukon/Koyukuk
Success in reading and writing	Yupiit

Annotated Bibliography

Jacobs, Heidi Hayes, Ed., ***Interdisciplinary Curriculum: Design and Implementation***. Association for Supervision and Curriculum Development, 1989.

Interdisciplinary Curriculum: Design and Implementation is a compendium of articles addressing the concept of interdisciplinary curriculum. Heidi Jacobs, in her chapter entitled "The Growing Need for Interdisciplinary Curriculum Content", builds a rationale for interdisciplinary curriculum. Subsequent chapters in the book provide the reader with a means for designing an integrated curriculum. Additionally, examples of operating models for interdisciplinary curriculum are provided.

Treffinger, D., Hohn, R., and Feldhusen, J., ***Reach Each You Teach***. D.O.K. Publisher, Inc. 1979.

Reach Each You Teach is a book about planning curriculum. Treffinger et. al., carefully leads the reader through steps in the curriculum development process. These steps include the development of goals, writing the content outline, focusing on thinking processes, responding to the planning matrix, wiring objectives, designing activities, evaluating learning and maintaining records. They emphasize the need for the curriculum developer to ensure objectives are written for all areas of cognition and affect.

Stiggins, R., Rubek, E., Quellmalz, E. ***Measuring Thinking Skills in the Classroom***. Northwest Regional Educational Laboratory, A National Education Association Publication, 1988.

Stiggins et. al., show the reader in *Measuring Thinking Skills in the Classroom* how to measure for all levels of Quellmalz's thinking skills. They provide an Assessment Planning Chart which guides the curriculum developer to assess students' understanding of objectives through oral, written and performance measures.

Interdisciplinary Guide
Response Sheet

After you have used this guide, please share your insights and suggestions to help us improve this document.

The parts of the guide that I used were: _____

_____

_____

_____

_____

_____

What I found most helpful in this guide was: _____

_____

_____

_____

_____

_____

What I would like to see changed in further editions of this guide is: _____

_____

_____

_____

_____

_____

_____

_____

Thank you for your help!

Please mail to:

Sandra Berry
Office of Basic Education
P.O. Box F
Juneau, AK 99811-0500
907-465-2841

Acknowledgements

The following individuals responded to DOE's request for Interdisciplinary Units. Their efforts were significant in determining the structure and content of this document.

School	Name	Unit Title
Akiak School Akiak, Alaska	David Bates Marylee Bates	"Wolves"
Blatchley Middle School Sitka, Alaska	Ginny Packer Dan Newman	"Body Sculpture" "Class Opener" "The Potato Project" "Create Your Own Mythical Holiday" "The Legend Assignment"
Cantwell School Cantwell, Alaska	Patricia McRae	"Corn, It's A-MAIZ-ING!"
Chapman School Anchor Point, Alaska	Jill Stanley	"Health &r Safety Course"
Chester Valley Elem. Anchorage, Alaska	Julie Frost Linda VanGoor	"Overall Intergration Plan"
Clark Junior High Anchorage, AK	Bernicé Kelley Mary Henderson Scott Batchelder Joan Torrage	"Kids Quake Check"
Clark Junior High Anchorage, AK	Dennis Stoval	"Middle East Interdisciplinary Unit" "Television Script Writing: "Making it Better"
Gastineau Elementary Juneau, Alaska	Susan Hanson Jackie Lorenson	"Interdisciplinary Unit Development Incorporating Cooperative Learning"

School	Name	Unit Title
Gastineau School Juneau, Alaska	Christine Crooks	"All You Knead to Know about Grain"
Iditarod School District McGrath, Alaska	Karen Ladegard	"Language Arts Project Sheet"
Lathrop High School Fairbanks, Alaska	Gayle Thieman	"Fictional Characters and their Journals in World History"
Lathrop High School Fairbanks, Alaska	Kathy Alton Carol Young	"Mythology Project" "Art Projects with a Science Theme"
Lathrop High School Fairbanks, Alaska	Judy Tolbert	"Interdisciplinary Activities in French"
Lathrop High School Fairbanks, Alaska	Al Fleming Cathy Mosley Jim Ranney Susan Stitham	"Ethics and Epidemics"
Nikiski Elementary Nikiski, Alaska	Ann E. Kendall	"Shakespeare's A Mid-Summer Nights Dream"
Nikiski Elementary Nikiski, Alaska	Sherry Matson	"Teaching Root Words Through Marine Biology"
Nunaka Valley Elem. Anchorage, Alaska	Deborah Cunningham	"Peanuts Across the Curriculum"
O'Malley School Anchorage, Alaska	Trisha Herminghaus	"General Interdisciplinary Outline"
Soldotna Elementary Soldotna, Alaska	Carol Smith	"Eagles"
Tri-Valley School Healy, Alaska	Jan St. Peters	"Spores and More!"
Whittier School Chugach, Alaska	Lydia Wood	"Book Log Data Base"

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